

# MAKE A CHAIN

GEOMETRY • LOGIC

- Using a coordinate system
- Spatial visualization
- Game strategies

## Getting Ready

### What You'll Need

Geoboards, 1 per pair

Sticky dots, 10 per pair

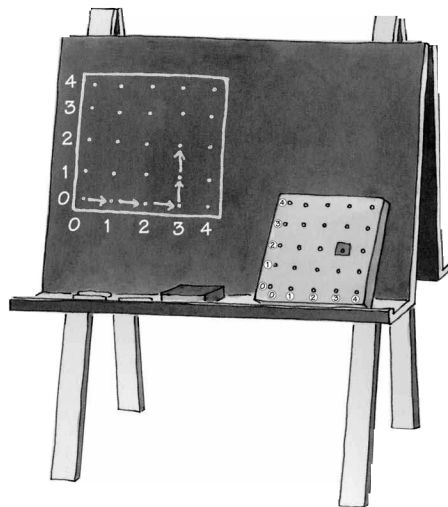
Square paper markers, 12 each of 2 colors per pair (or see page 95)

Overhead Geoboard and/or geodot paper transparency (optional)

## Overview

In this game for two players, children take turns placing markers on Geoboard pegs in an effort to be the first to make a chain from one side of their Geoboards to the other. In this activity, children have the opportunity to:

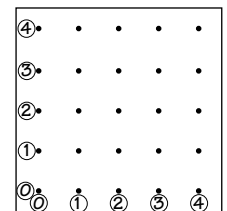
- ♦ use a coordinate system of ordered pairs
- ♦ recognize the importance of the sequence of the numbers in an ordered pair
- ♦ develop strategic thinking skills



## The Activity

### Introducing

- ♦ Before introducing the lesson, number the rows and columns of pegs on the Geoboard, using sticky dots as shown.
- ♦ Display a Geoboard. Tell children that the location of every peg can be indicated by a pair of numbers.
- ♦ Write (2,3) on the chalkboard and press a marker onto the corresponding peg.
- ♦ Do the same with the ordered pair (4,1).
- ♦ Ask children to try to explain how you knew where to put their markers.
- ♦ Establish that, starting with the peg at (0,0), the first number of an *ordered pair*—as the two numbers are called—tells how many pegs to count across. The second number tells how many pegs to count upward.

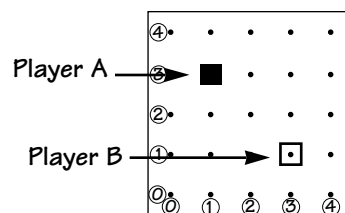
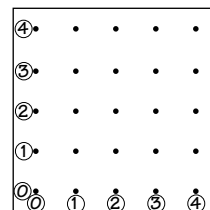


## On Their Own

### Play *Make a Chain!*

Here are the rules.

1. This is a game for 2 players. The object of the game is to form a chain of 5 or more markers from one side of the Geoboard to the opposite side. The markers in the chain must link pegs that are next to (not diagonally across from) each other. The chain does not have to be straight.
  2. Players use a Geoboard and sticky dots to make a game board, as shown.
  3. Each player chooses a color of square paper markers. Players decide who will go first.
  4. Players, in turn, call out an ordered pair of numbers, then press their marker onto the matching peg. For example, Player A calls (1,3) and places a marker as shown. Player B calls (3,1) and places a marker as shown.
  5. If a player thinks the other player's marker isn't in the right place, he or she says "Challenge!" Together, the players check the move. Whoever was wrong loses a turn.
  6. Play continues until someone makes a continuous chain of markers that connects two opposite sides. If neither player can make such a chain, the game is a draw.
- Play five games of *Make a Chain*.
  - Be ready to talk about good moves and bad moves.



## The Bigger Picture

### Thinking and Sharing

Invite children to talk about their games and describe some of the thinking they did.

Use prompts such as these to promote class discussion:

- ◆ What was the hardest part about playing *Make a Chain*? the easiest?
- ◆ Did you ever call out "Challenge!"? If so, describe what happened then.
- ◆ Do you have any favorite moves? What are they?
- ◆ Did you make any moves that you wanted to take back? Explain.
- ◆ Did you have a moment of surprise during a game? When?
- ◆ Did anyone develop a strategy that he or she thinks will always work? Tell about it.
- ◆ Is it best to go first? Explain.

## Extending the Activity

1. Have children play *Make a Chain* on a larger game board, such as a ten-by-ten grid.

## Teacher Talk

## Where's the Mathematics?

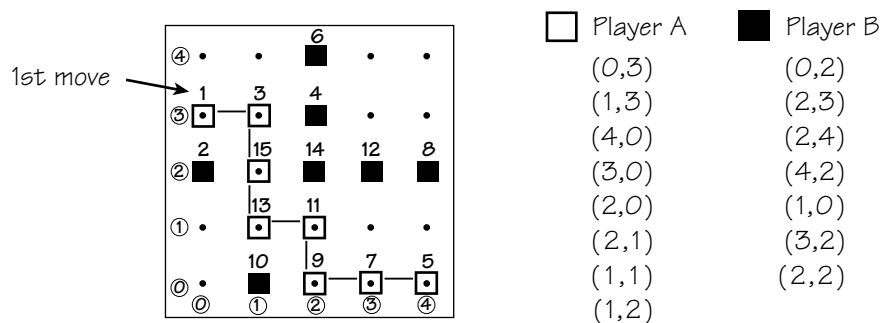
*Make a Chain* introduces children to one of the simplest, most powerful ideas in all mathematics—coordinate graphing. This idea made it possible to represent an algebraic idea geometrically. A simplified description of coordinate graphing is this: If a pair of perpendicular lines are drawn, the location of any point in a plane can be given by telling its distance from each of the two perpendicular lines.

As they play *Make a Chain*, children can learn the value of using ordered pairs of numbers to identify locations. Although the pegs on the Geoboard could be labeled in some other way, such as by letters or by numbers from 1 to 25, a system of ordered pairs of numbers has the beauty of efficiency and economy. This system is also easily expanded to a grid of any size.

In planning and calling out their moves, children may sometimes name the coordinates incorrectly or forget that the counting of the pegs in the rows and columns begins with 0, not 1. When challenged by an opponent, a player can check and correct such errors.

Children quickly learn that attempts to make chains that go straight across the board vertically or horizontally are easily thwarted, whereas chains that are not straight may be harder for an opponent to block.

Some children try to confuse their opponent by placing their markers in a seemingly random way on opposite sides of the Geoboard, and then attempting to connect the chain in the middle. In the game shown below, this was accomplished by Player A.

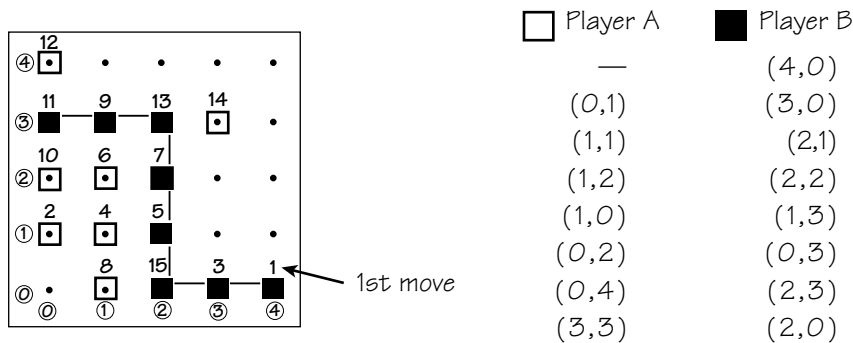


Player A successfully  
confuses Player B and wins.

Children who find themselves on the defensive, may be surprised to see that there is a way to make a chain by connecting markers they had previously placed in an effort to disrupt their opponent's path. In the following game,

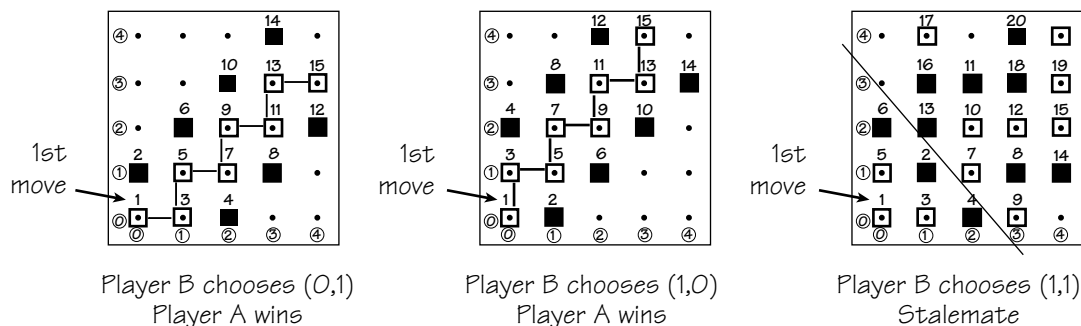
- Have children create shapes on their Geoboards and write—in order—the coordinates of all pegs that are corners of the shapes. Then have them ask other children to use the lists of coordinates—without looking at the original Geoboard—to recreate the shapes.

Player B was able to form a chain using some of the markers that were played to block Player A's chains.



If both players make extensive use of blocking strategy, there may be games which no one wins.

Going first is an advantage most of the time because it puts the other player on the defensive. For example, consider these three scenarios. Imagine that Player A is first and places a marker at (0,0). Hoping to block Player A, Player B considers three choices: (0,1) (1,0), or (1,1). If Player B chooses (0,1) or (1,0), Player A can win since he or she will always have, on subsequent moves, at least two choices, both of which lengthen the chain in a winning direction. If Player B chooses (1,1), Player A may not be so lucky. A stalemate can occur.



*Make a Chain* requires children to think both offensively and defensively. In addition to planning and implementing their own strategies, children must anticipate what their opponent may be planning to do. Attending to both of these tasks helps children develop their logical thinking skills.